Emerald Ash Borer Identification

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Background

• Proof-of-concept project for City/County of Denver
• Remote sensing using multispectral camera to identify Emerald Ash Borer (EAB) infestation
Goals

• Early identification and monitoring of Emerald Ash Borer infestation

• Develop algorithms and classifications quantifying stress levels and identifying tree species, moving towards automation of processes

• Develop replicable procedures/analysis for business offering and adaptation for future projects
Participants

- SME: Dan Staley, Arbor Drone (PIC)
- Collection: Darren Ceckanowicz, Colorado College & Tim Haynie, Spectrabotics
- Data Processing: Spectrabotics
Project Design

• Fly parks, Rights of Way in City/County of Denver to obtain sample of tree species (including ash)
• Obtain imagery of EAB-infested trees in Boulder
• Micasense RedEdge sensor carried by custom octocopters
• Choose Vegetation Indices (VIs) to best identify early infestation
• Spectral classification & statistical analysis for tree species
Aircraft & Equipment

Darren Ceckanowitz (Colorado College) and custom octocopter "The Tractor"

Tim Haynie (Spectrabotics) and custom octocopter “The Tractor”
Plant Physiology and Early Detection

Reflectance

anthocyanin  chlorophyll a
+ individual species reflectance

chlorophyll b
carotenoids

wavelength (nm)

0%  20%  40%  60%  80%  100%

500  550  600  650  700  750  800  850  900
Early Detection Criteria

- Consider tree physiology and reaction to manipulate reflectance values in useful analysis
- Vegetative Indices (Band Math)

\[
MCARI2 = \frac{1.5[2.5(\rho_{800} - \rho_{670}) - 1.3(\rho_{800} - \rho_{550})]}{\sqrt{(2 * \rho_{800} + 1)^2 - (6 * \rho_{800} - 5 \sqrt{\rho_{670}}) - 0.5}}
\]

- Looking for clues in chlorophyll, anthocyanin, & carotene for early detection
Takeaways

• This is not your typical mapping or NDVI application
  • Correlating imagery with known objects (trees) on the ground
  • Appropriate sensors required
  • Appropriate collection processes (calibrated data)
• Science is well known – Application of the science less so
Industry Specialist/
Subject Matter Expert

Data Collector

+ Raw Data
+ Partial Analysis
- Fusion/
  Dissemination?

Data Processing & Dissemination

+ Raw Data
+ Presentation
- Solution for an
  Unknown Problem?

- Questionable Collection?

+ Analysis
+ Presentation

Rocky Mountain UAS Meetup - 16 August 2017